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**Presentation to:** MI –AWWA

Ground Water Conference

**Topic:** Water Quality Management

**Presenter:** Dan Kitchen – Water System Consultant

**February 25th, 2009**

# Water Distribution Path….

Start here ↓

- **Water Treatment plant**
  - Air Stripping Towers
  - Membranes
  - Filter Media
  - Vessels/walls/troughs
  - Aerators

End here ↓

- **Potable Storage Vessels**
  - Clearwells
  - Underground reservoirs
  - Ground Storage Vessels
  - Elevated Storage Vessels

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# Filter Media Maintenance?????
## - a couple of options……

- Physically replace every 5, 10, 20, 50 years? How to, when to, who will perform the physical job?
- Chemically clean? How often, who to use, how much organics will be removed? Will the cleaning completely strip the anthracite coating? Will the anthracite maintain its structurally integrity after cleaning?

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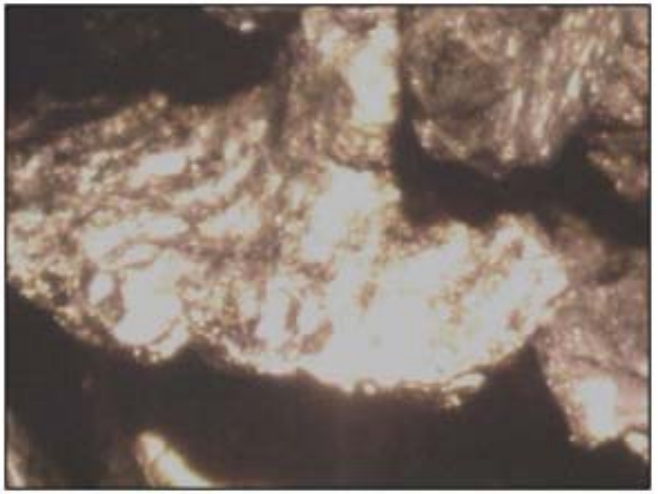
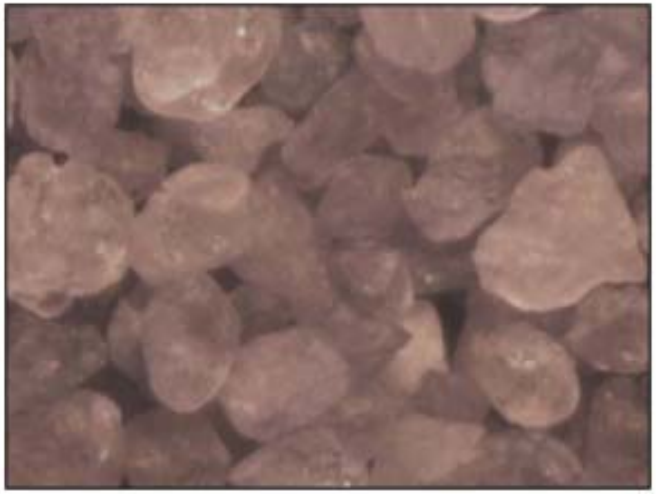
# Filter Media – Before & After Chemically cleaning

Anthracite, before



Anthracite, after



Sand, before

Sand, after

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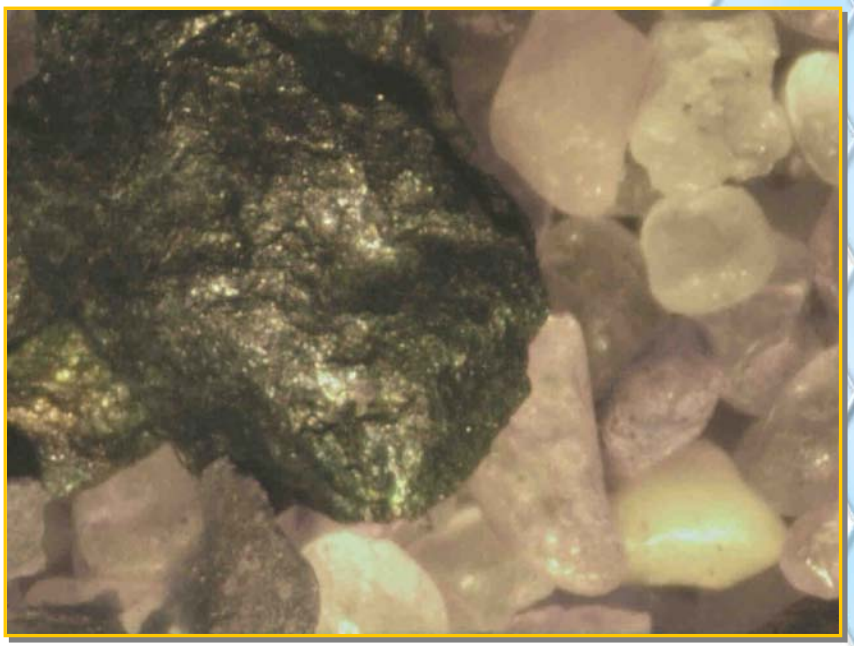
# More media pictures…..



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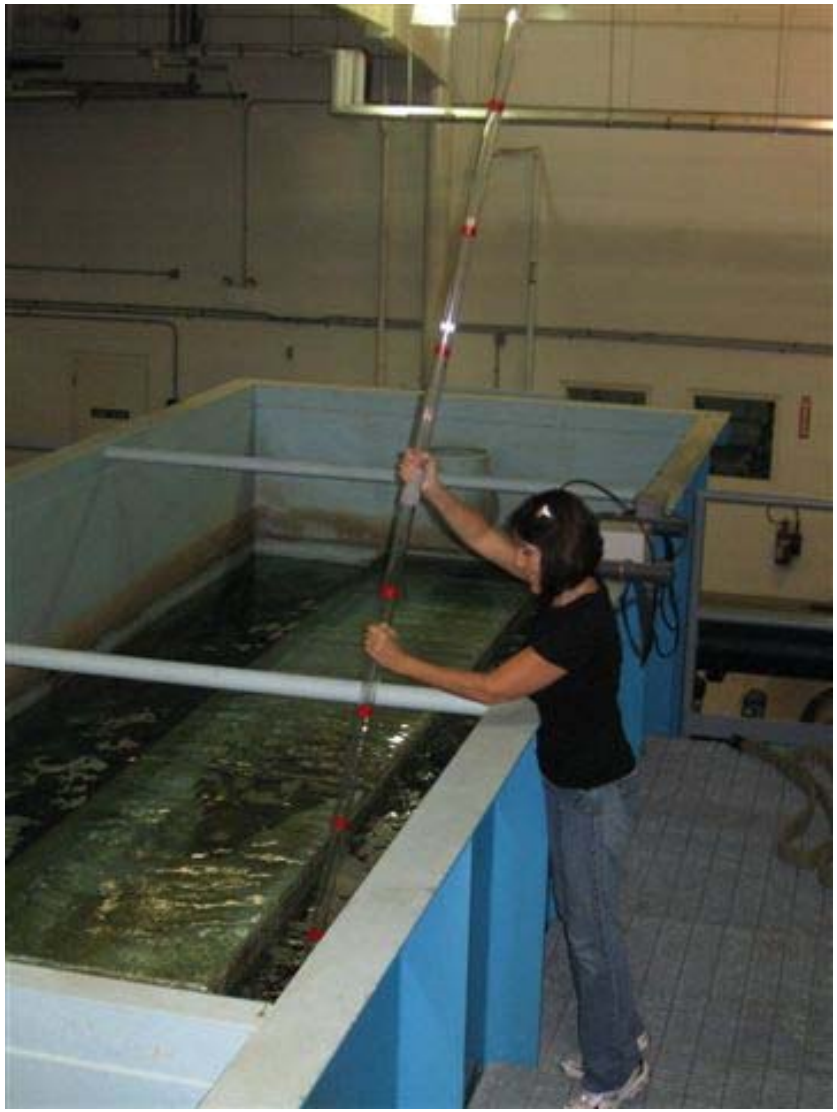
# Core Sampling



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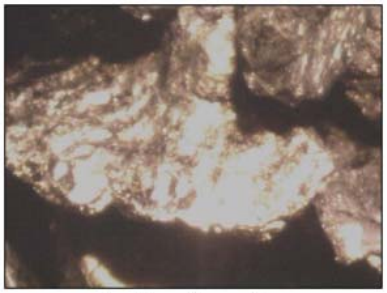
# Filters and Media

Anthracite, before

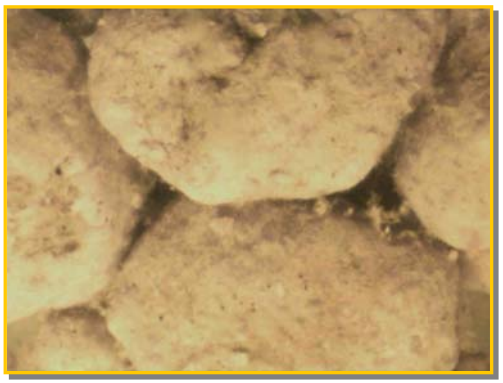


Anthracite, after

Sand, before

Sand, after

- **Media and vessel are typically cleaned in one 24 hr period**
- **Sampling and analysis determines treatment dosage and confirms that media can be restored (angularity intact)**



**Before**

**After**

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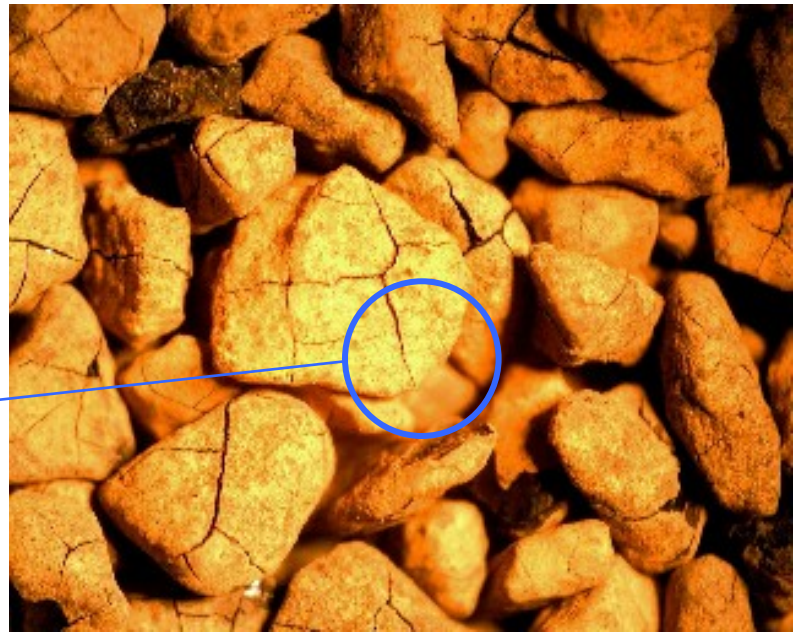
Anthracite is entirely covered with apparent crust making the media appear rounded



Anthrasand, Untreated

Crust is broken up and therefore much of the remaining will break off during backwashing

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# Clearwell Chemical Cleaning Before and After Photos

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# Clearwell Chemical Cleaning Before and After Photos

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# Clearwell Chemical Cleaning Before and After Photos

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# Clearwell Chemical Cleaning Before and After Photos

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# Clearwell Chemical Cleaning Before and After Photos

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# Filter Cleaning

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# Filter Cleaning

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# Water Plant: Details Chemical Clean

## Water Quality Management

- **NSF 60 certified chemicals**
- **Off-line, on-site application**
  - Typically requires only 24 hours
- **Removes mineral and organic deposits, lime scale and biofilm from filter media, vessel walls, under drains, and troughs**
  - Gravity and pressure filters
- **Cleans air stripping towers**

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# The Impact of Fouled Filter Media on Water Plant Operations

- Growth in media volume leads to media losses during backwash
- Encapsulation of media leads to increased channeling; decreased filter efficiency
- Increased frequency of backwashes
- Reduced plant capacity
- Increased disinfectant demand
- Increased DBP's
- Poorer water quality
- Media losses during backwash

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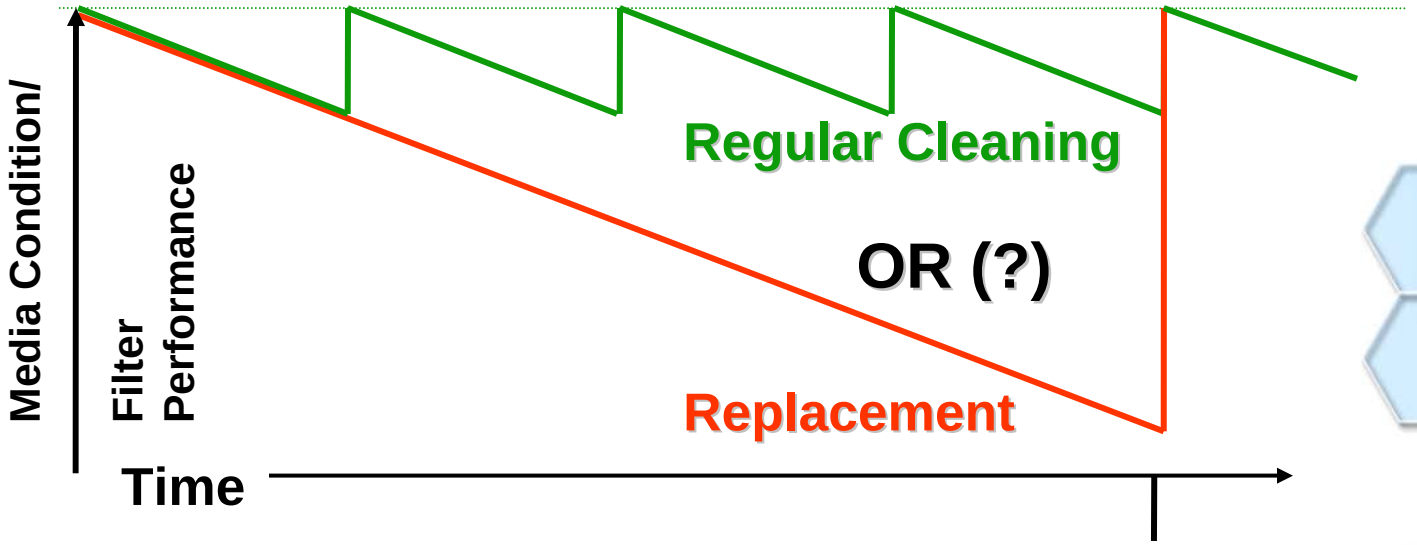
# Filter Media:
# Cleaning or Replacement?




## *Chemical Cleaning of Filter Media:*

- **Recondition media by removal of deposits**
  - In most cases, media is returned to near original condition
- **Improve performance, utilization/capacity, throughput**
  - Reduce backwash frequency/head loss, thereby, increasing capacity
- **Minimize/eliminate loss of media during backwash**
  - Deposits cause media volume to “grow”; it also causes the media to mix and lose efficiency since their densities become more similar
- **Achieve higher average operating filter performance**

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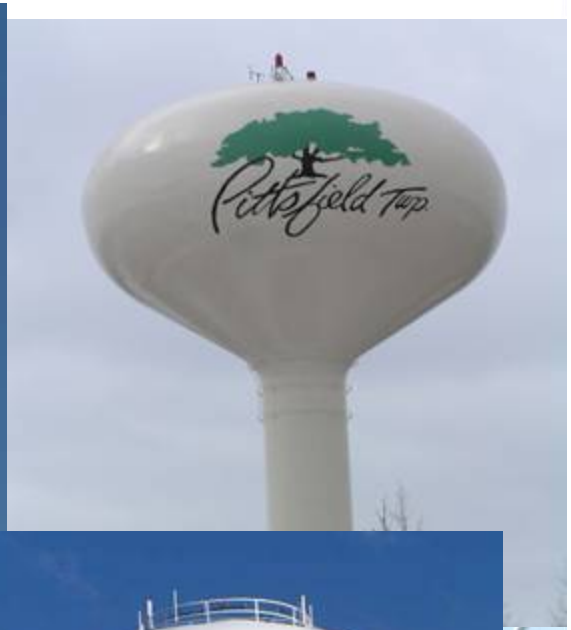
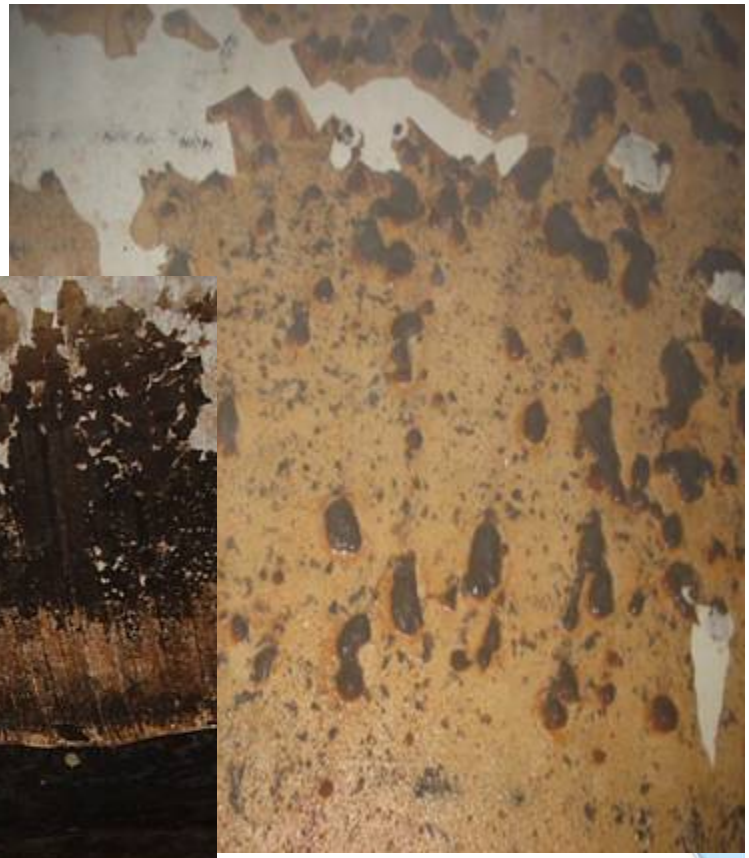
# Water Tank Asset Management
# =
# Water Quality Management








# Bio-film in Storage Vessels



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# Bio-film in Storage Vessels

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# CHEMICAL CLEANING OF THE STORAGE TANK

## Removal of Bio-film from all tank surfaces:

- **Reduces disinfectant demand.**
- **Reduces risk of nitrification.**
- **Reduces risk of DBP formation.**

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# Bio-film removal process

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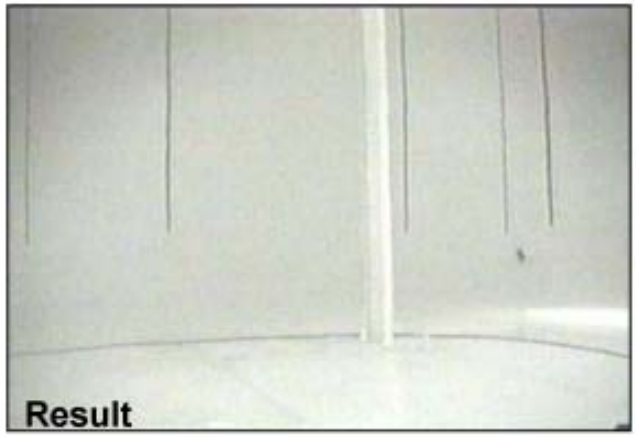
# Chemical Tank Cleaning

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WaterMix
The Right Mix for Cleaner Water
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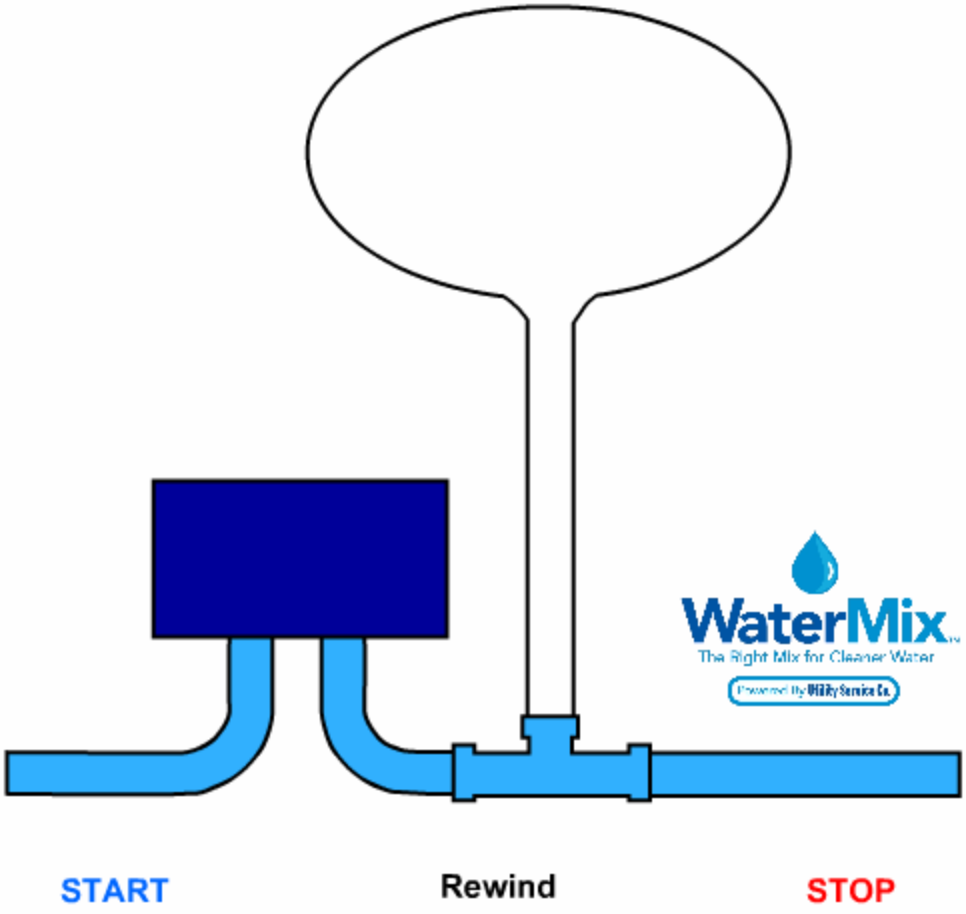
# Stagnation/Stratification

**Without an Active Mixer, Only a Complete Flush Eliminates the Stagnant Layer**

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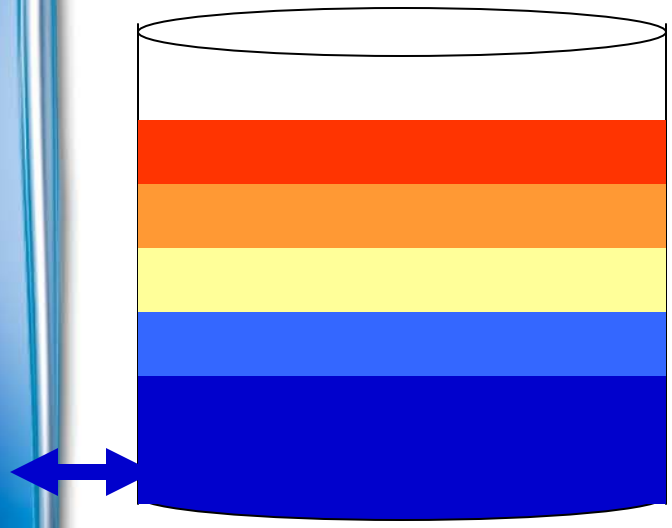
# Stratification, Chlorine Demand/Depletion & Biological Growth: Active Mixing Systems



Moving up through the layers

- Temperature increases
- Chlorine residual decreases
- Organics increase (formation of biofilm on tank surface)
- Nitrification increases
- Water quality decreases

The risk is that a sudden large draw (e.g., a broken main, large fire) can pull the old, low quality water into the system

**Water Quality Management/ Risk Prevention:**

- **Active 24/7/365 mixing system to eliminate stratification**
- **Regularly scheduled tank cleaning including biofilm removal**

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# Mixing Systems in Storage Vessels

- **Passive Systems**

- **Active Systems**

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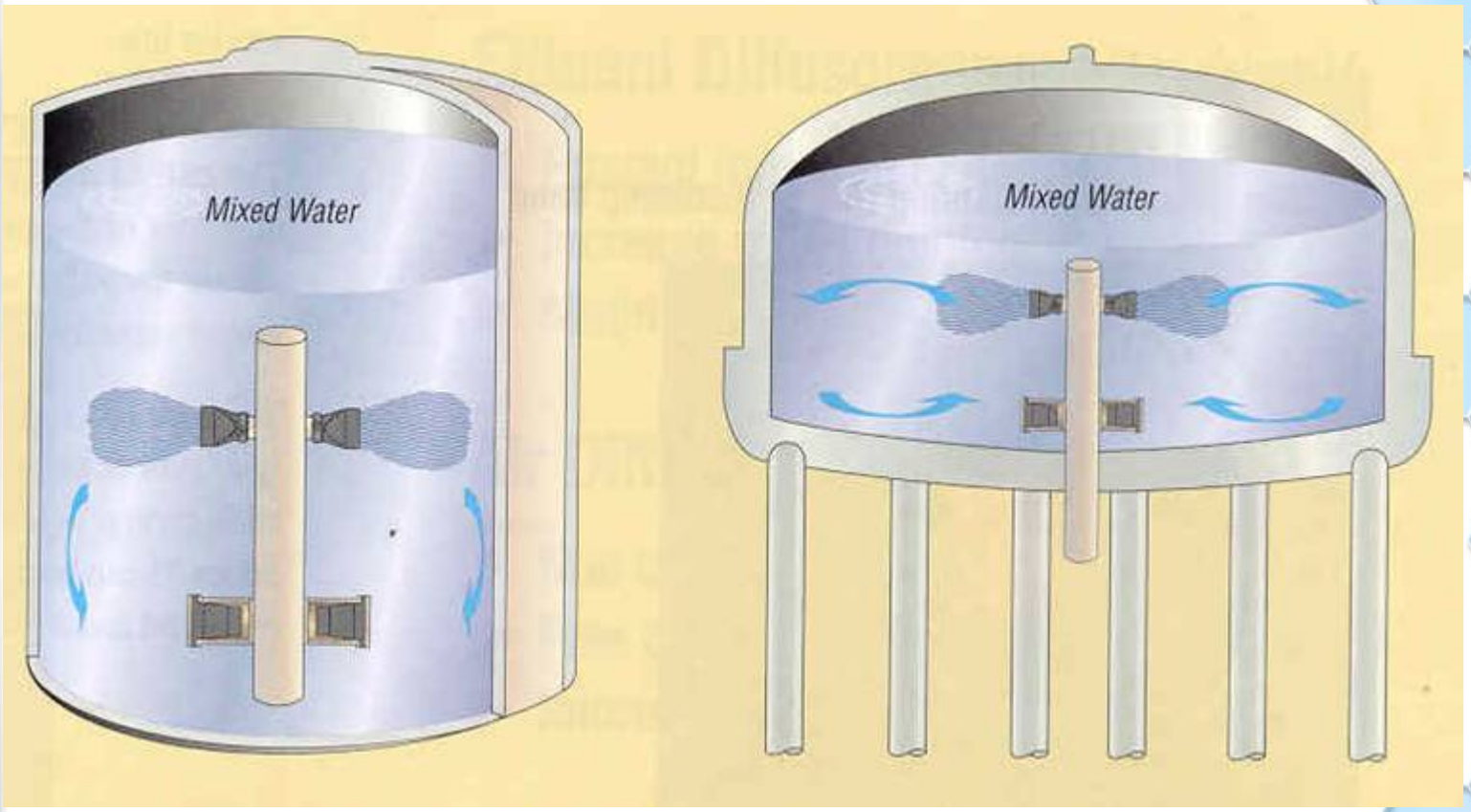
# PASSIVE MIXING SYSTEMS:

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# Mid-tank Passive Mixing Valve Technology

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# Active Mixer – Vortex Design

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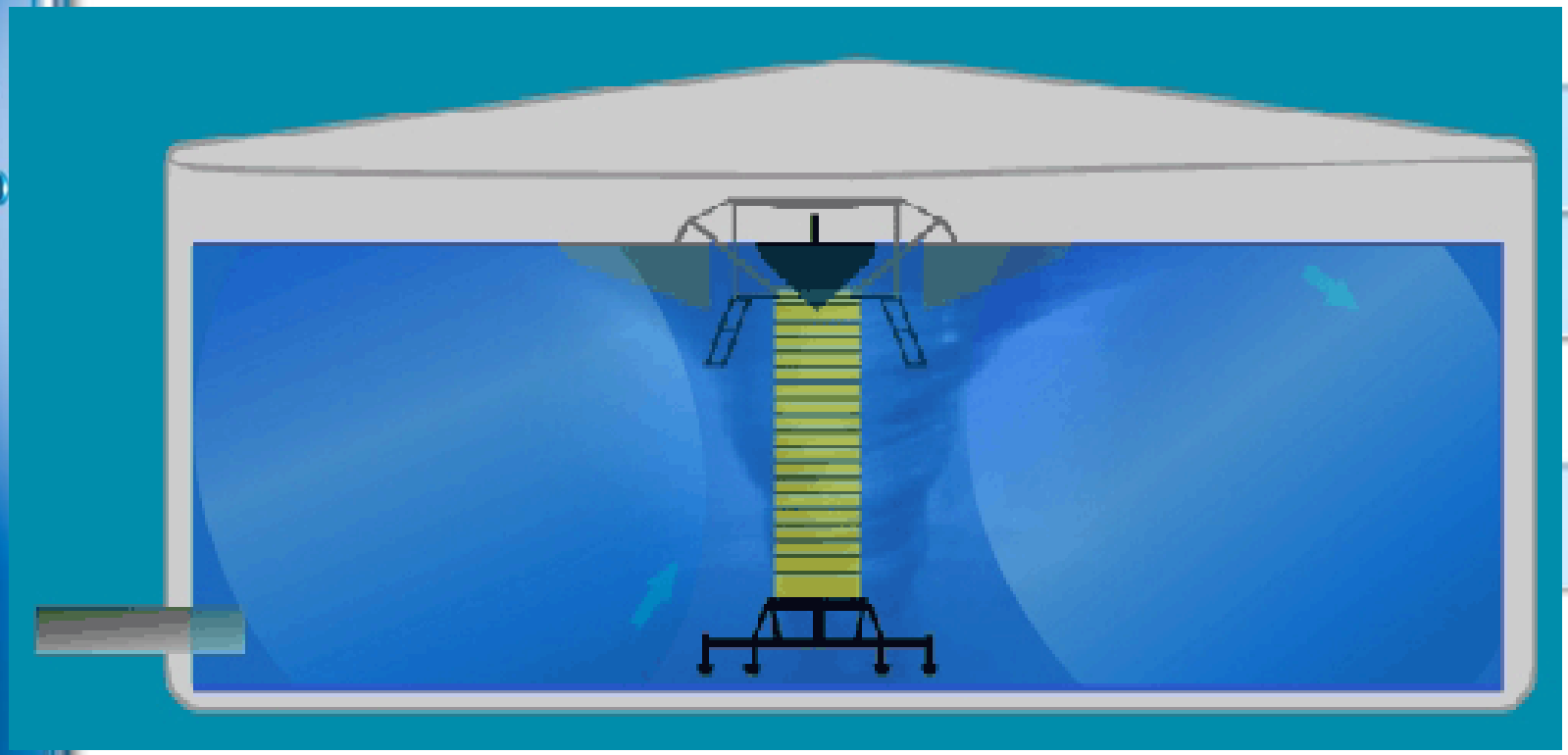
# Active Mixing



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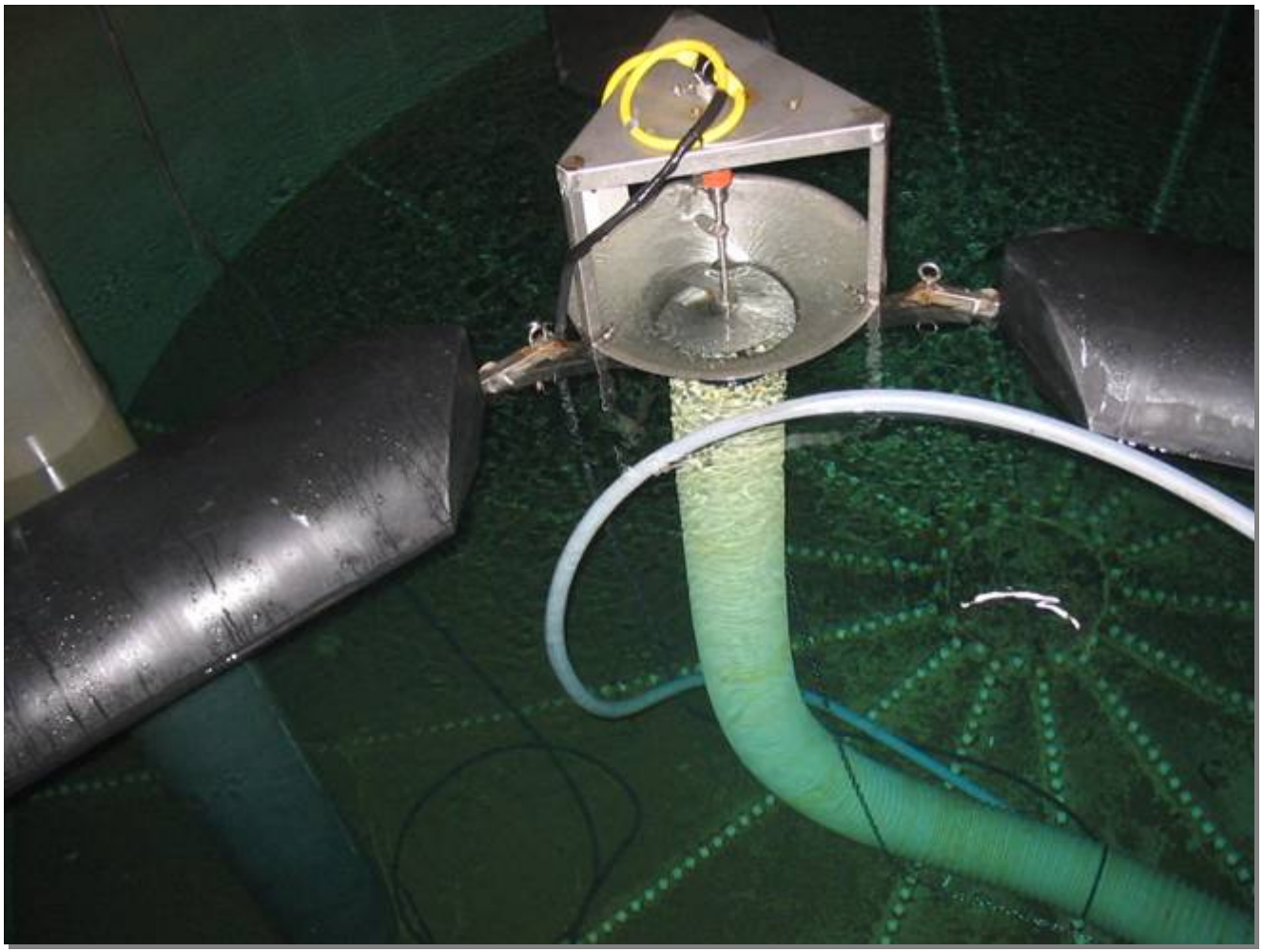
# Active Mixing System



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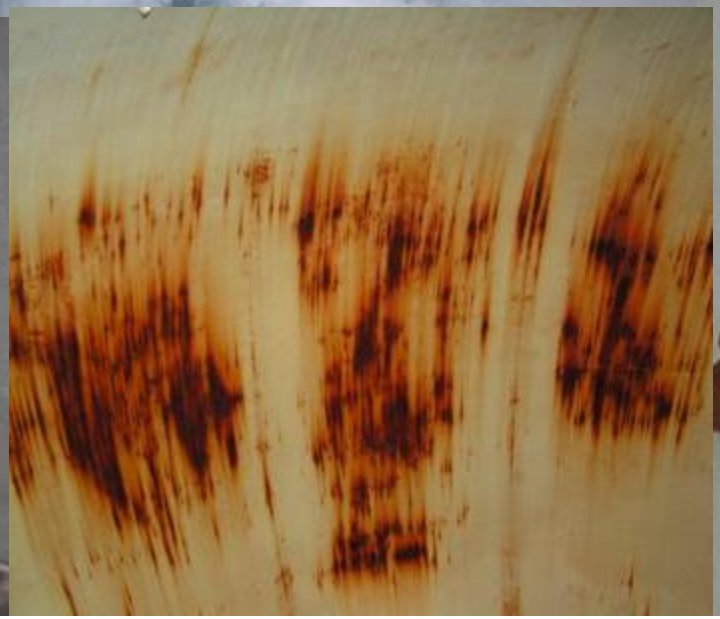
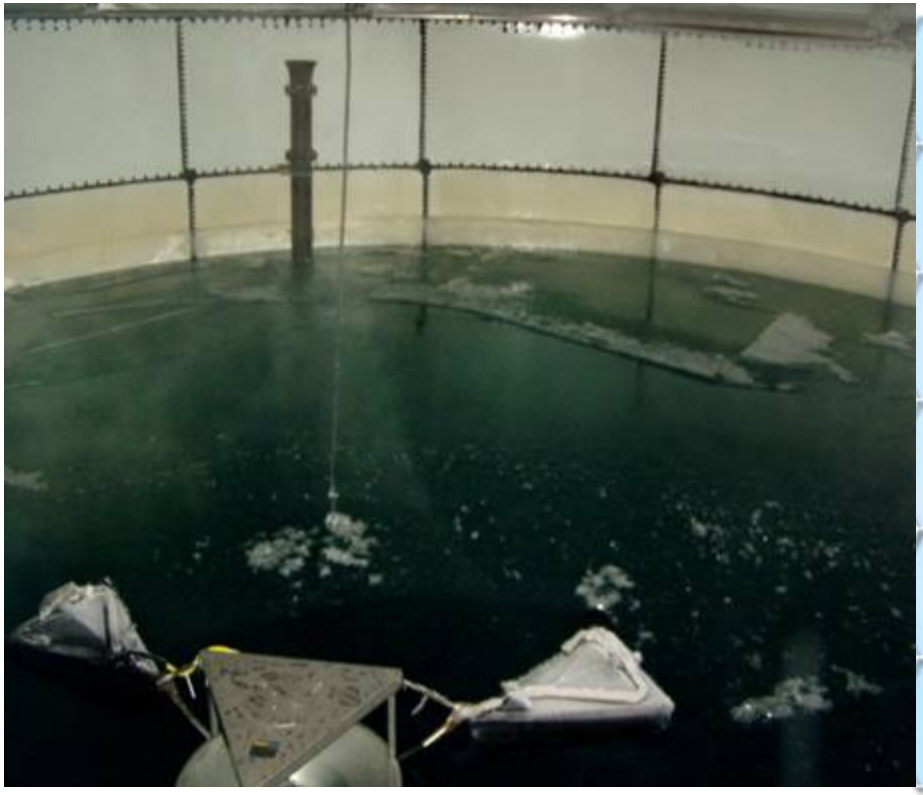
# Cold Conditions – No Mixing System



# Active Mixing = Minimal Ice



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# ACTIVE TANK MIXING SYSTEMS

## Active tank mixing systems:

- **Offer continuous mixing, 24/7/365.**
- **Eliminates thermal stratification.**
- **Consistent water age throughout tank.**
- **Stabilizes disinfectant residual.**
- **Minimizes risk of nitrification.**
- **Minimizes Bio-film growth.**
- **Minimizes ice build up.**

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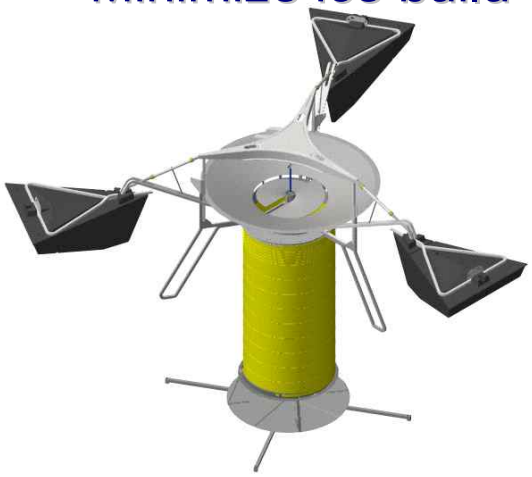
# Water Storage Tank/Vessel

## Water Quality Management

- **Active Mixing System, NSF 61 certified**
- **Eliminate stratification and stagnation**
- **Minimize bio growth, nitrification >> stabilize Chlorine residual**
- **24-7-365 mixing**
  - Independent of filling cycles
- **Near laminar flow**
  - Far greater “reach” than turbulent mixers
  - Eliminates dead spots
  - Minimize ice build-up



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# Water Storage Vessel Issues

- **Inspection**
  - Safety
  - Security
  - Coatings
  - Sanitary
  - Structure
- **Cleaning**
  - Washout/ Chemical Cleaning
- **Mixing**
  - Eliminating Water Stratification and damaging ice build-up

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# Sanitary Conditions

- Roof Openings
- Access Hatches
- Low Spots
- Vents
- Overflows

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# Sanitary Conditions

# Sanitary Conditions

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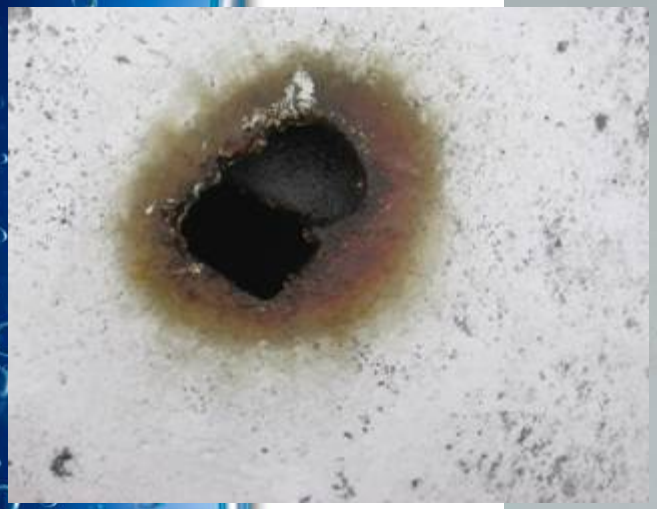
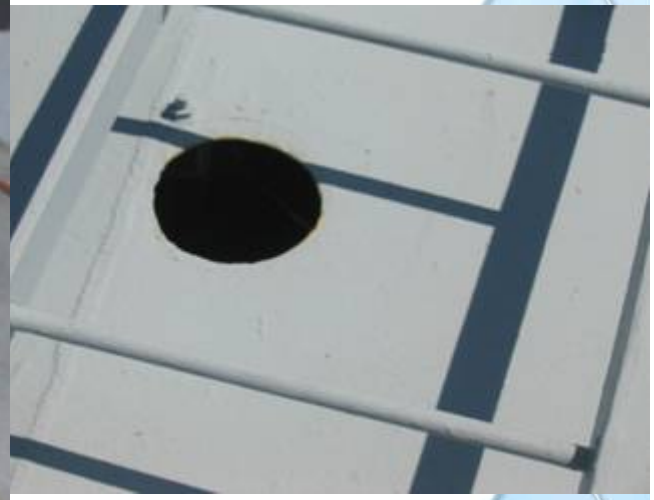
# SANITARY CONDITIONS

# Roof Openings





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# Overflows

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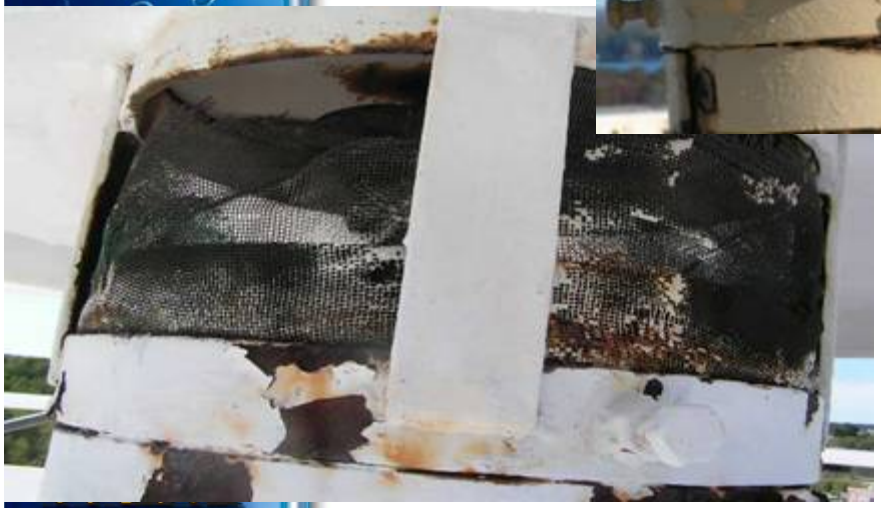
# Vents



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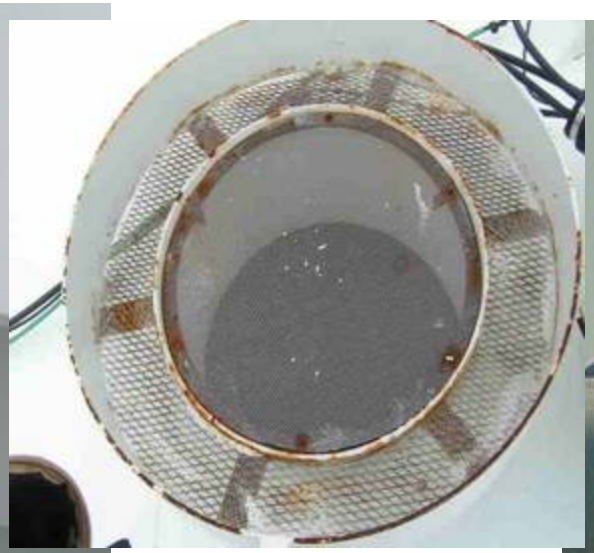
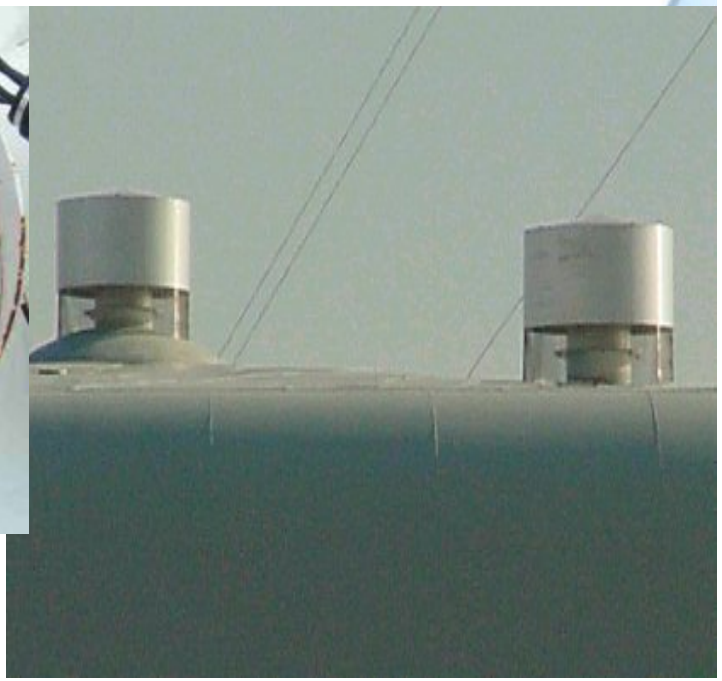
# Vents





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# SANITARY CONDITIONS
## Sediment



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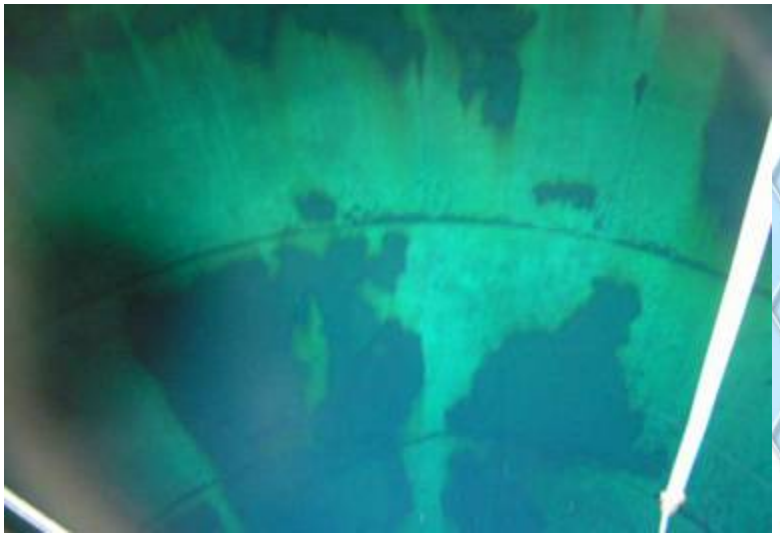
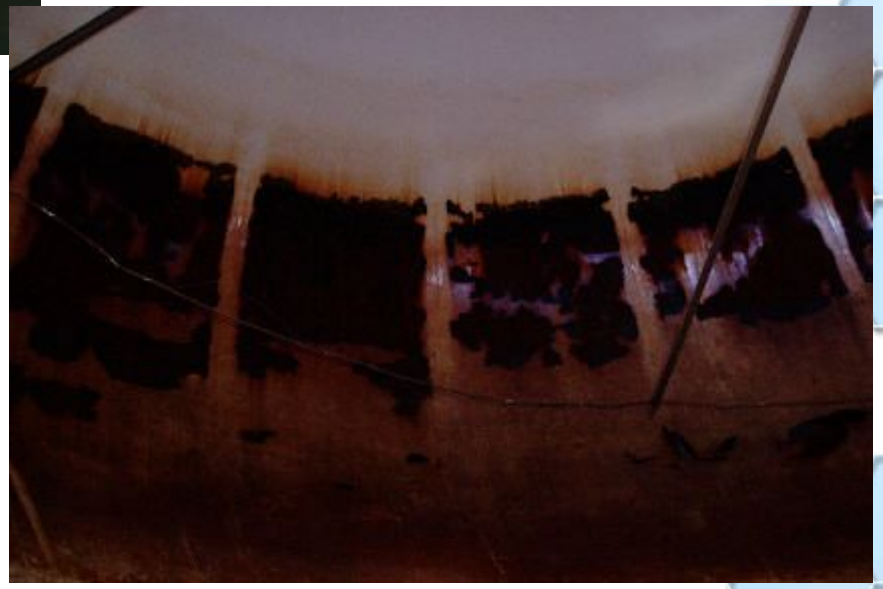
# Interior “Wet” Coating Failures = Anchor Points for Bio-Growth





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# Coatings Condition
# *"Grease and Wax Linings"*

- **NOT AWWA D102-03 APPROVED**

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# Security Issues

- Exterior ladders terminate at least 12 ft above grade
- Properly fenced site
- All doors and access hatches are locked.

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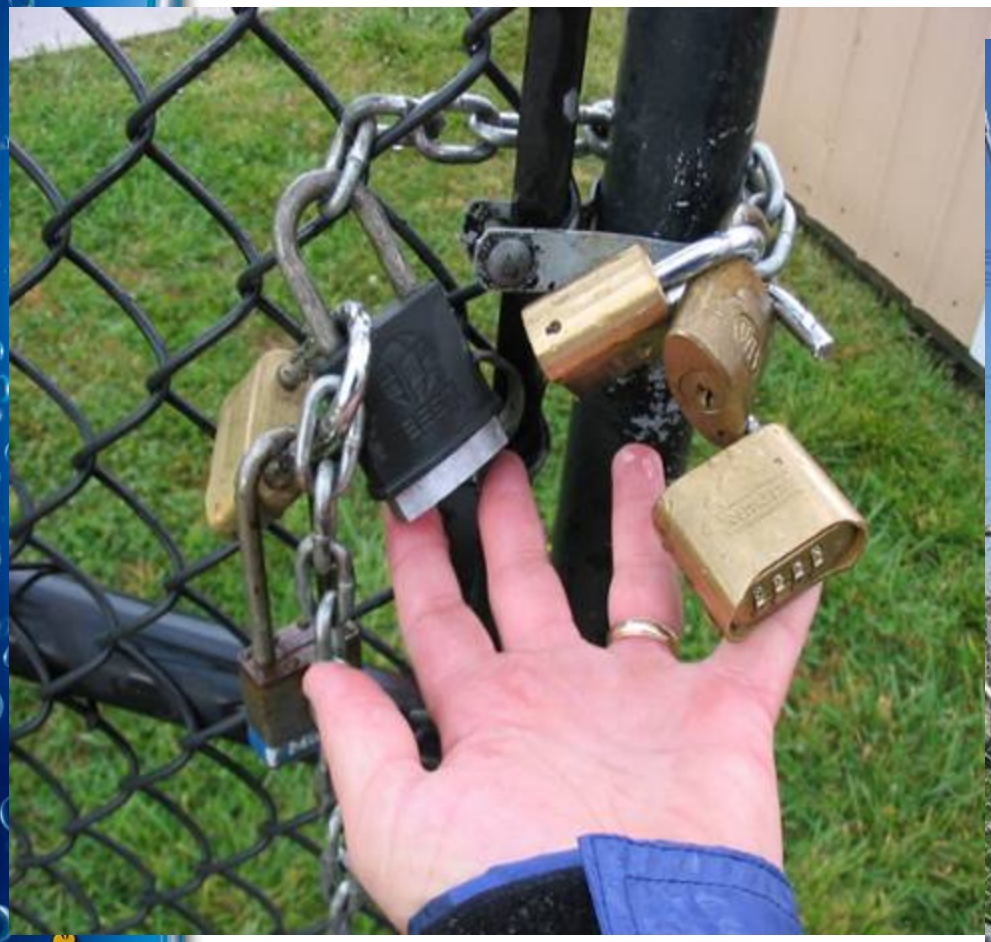
# Security Issues



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# Security Issues

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# Security Issues

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# Security Issues

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# Coatings Condition

- Type and general condition
- Approximate percentage and type of failure
- Extent of pitting
- Thickness and Adhesion
- Heavy Metals?

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# Coating Conditions

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# Inspection Frequency

Drive-by

**Twice per week**

**Walk Around**

**Once/twice per month**

**Visual inspection**

**Annual**

**Dry inspection**

**2-3 years**

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# Water Quality Management:

- **Using all three (3) water quality management tools:**

  **1) Chemical Cleaning**

  **2) Active Tank Mixing System**

  **3) Tank Asset Management**

  **offers a synergistic effect on water quality management.**

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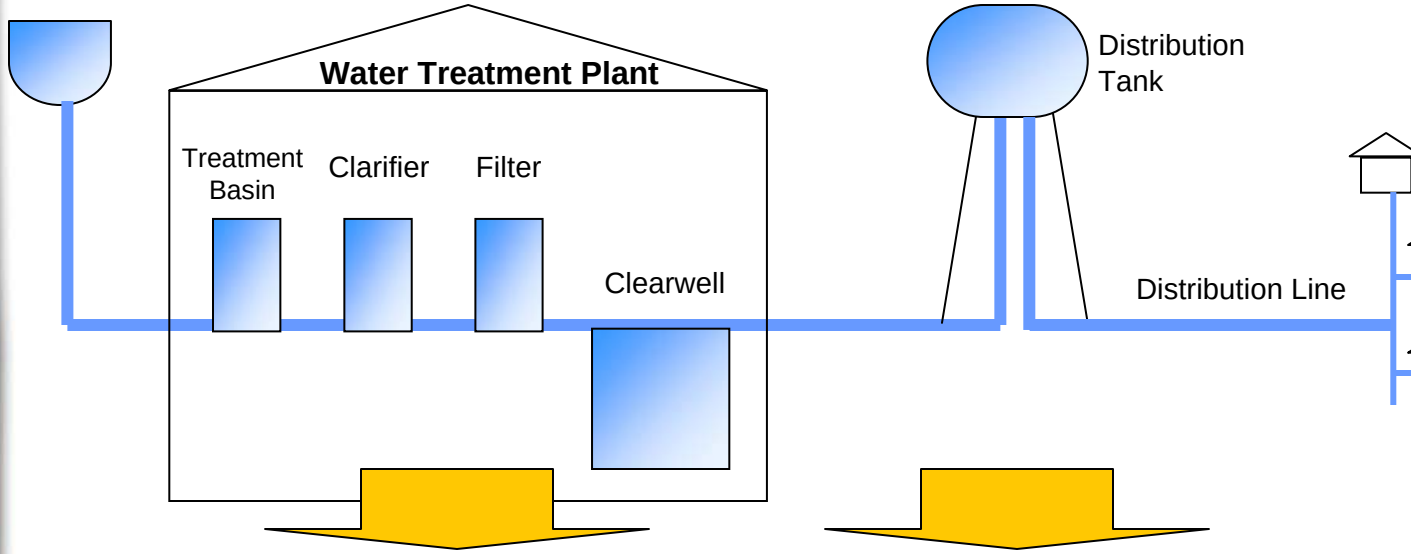
Home

# Standard Water System




- Chemical Cleaning of
  - filter media
  - vessels/walls/troughs
  - air strippers
  - aerators

- Bio film removal
- Active mixing (24/7/365 elimination of temperature stratification)
- Tank asset management

Water Quality Management!

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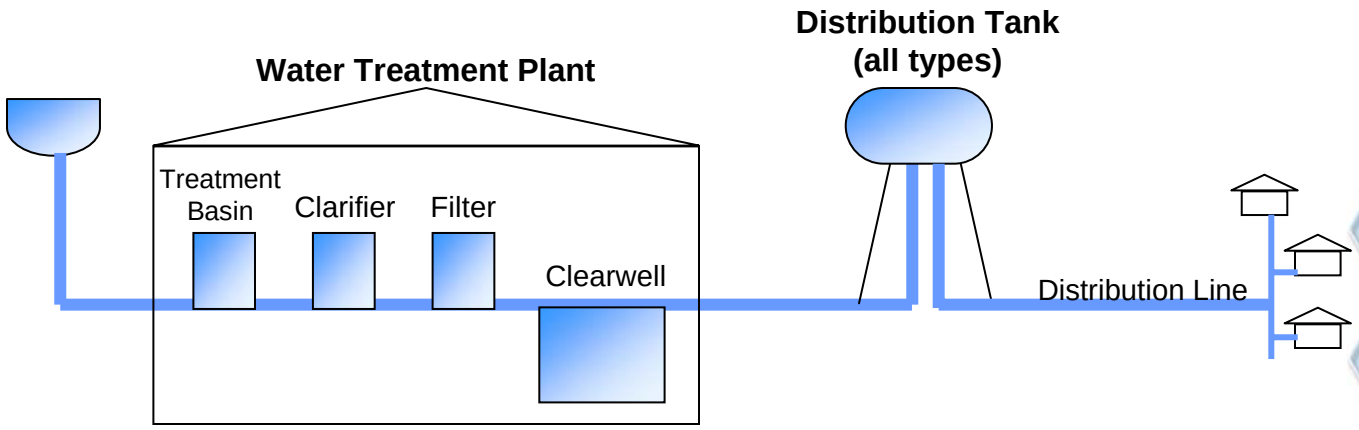
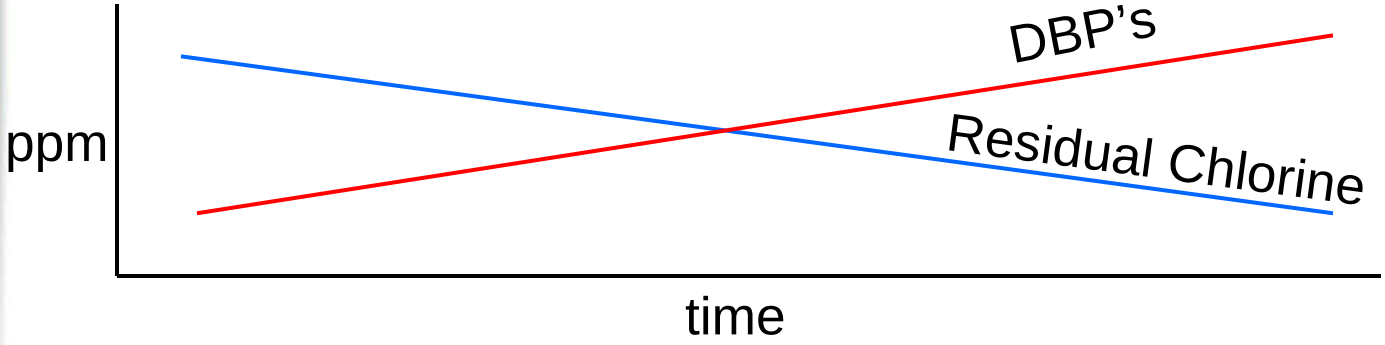
⇧ Home

# Standard Water System

## Chlorine Demand and DBP Formation; Cleaning of Vessels




**Once formed, there's no way to reduce DBP's or nitrification without dumping the tank**

⇨ **There cannot be a "weak link" in the system or the approach to managing water quality**

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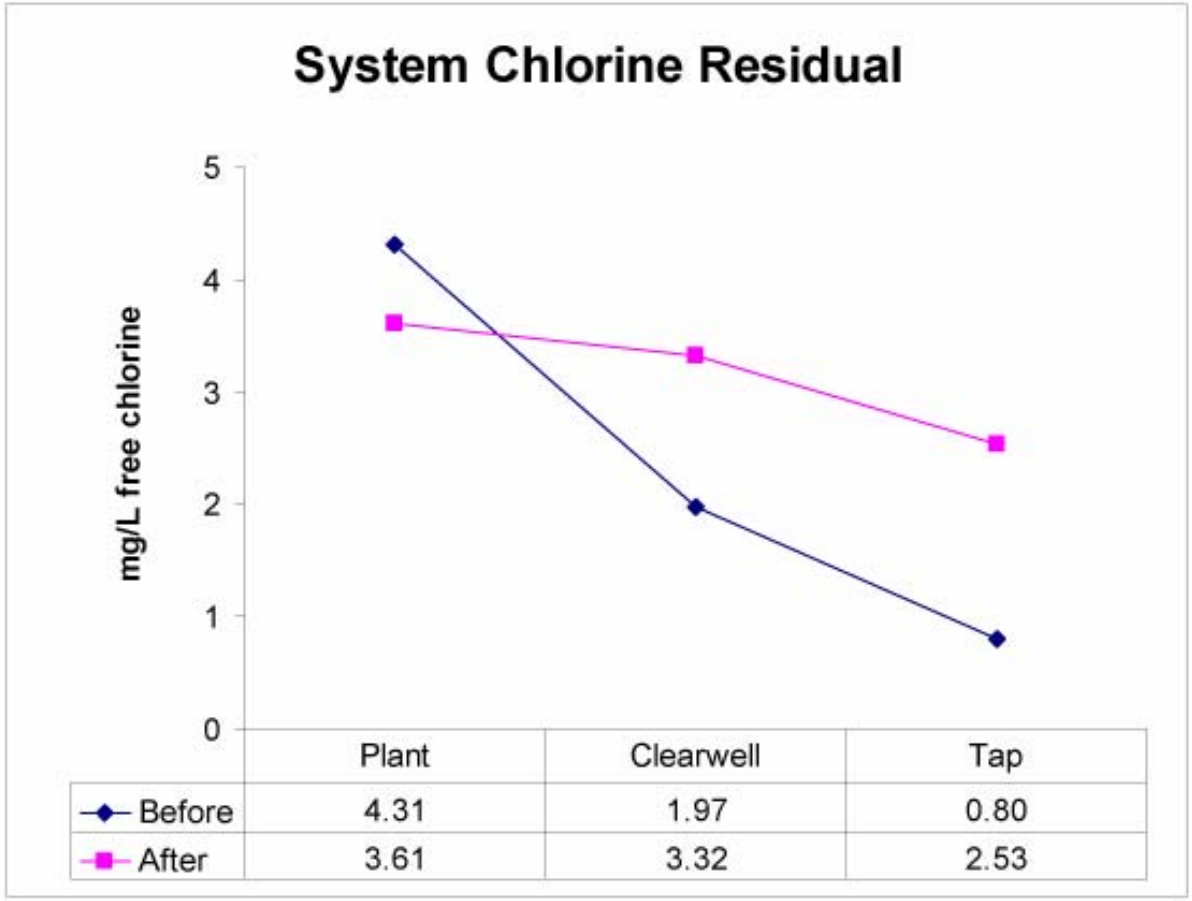
# Results of a Clean System




| | Plant | Clearwell | Tap |
|---|---|---|---|
| Before | 4.31 | 1.97 | 0.80 |
| After | 3.61 | 3.32 | 2.53 |

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# Burning Questions???

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